

July 16, 1963

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METHOD OF CONSTRUCTING MOVABLE BUILDING SECTIONS  
AND APPARATUS APPLYING THIS METHOD  
Filed April 10, 1959

3,097,493

Fig. 2

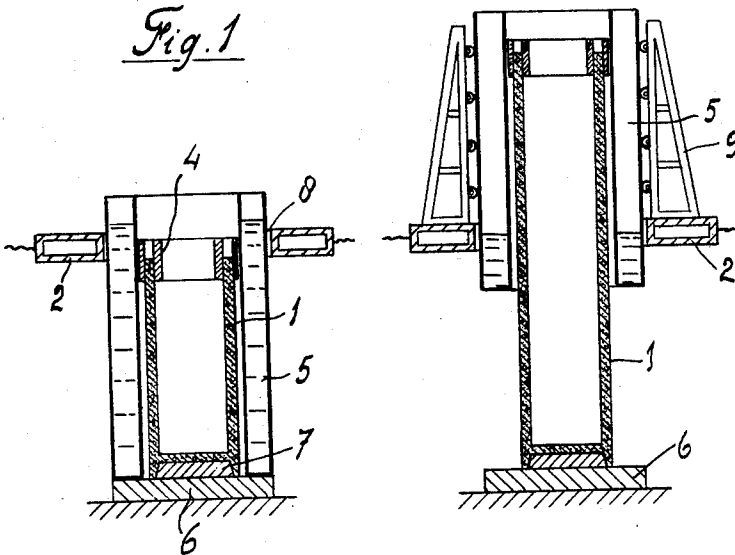
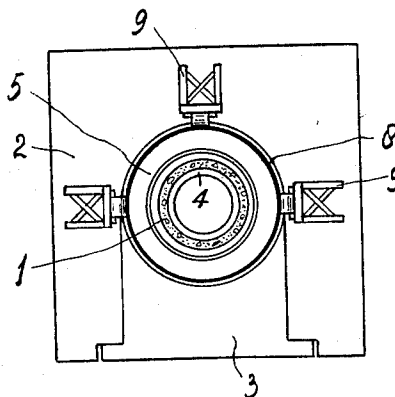


Fig. 3



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## METHOD OF CONSTRUCTING MOVABLE BUILDING SECTIONS AND APPARATUS APPLYING THIS METHOD

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Filed Apr. 10, 1959, Ser. No. 805,424  
4 Claims. (Cl. 61—43)

The invention relates to a working method for the construction of transportable building sections, for tunnels or other purposes, of great length, whereby the sections are built vertically from a floating member by means of a sliding mould.

The invention further relates to an apparatus applying this method.

The invention specifically relates to the construction of sections for tunnels being built according to the so-called sinking method, when the pre-constructed tunnel sections are taken to the place of destination and sunk on the required spot. The tunnel sections are made of concrete; because of their very large size these sections have so far been exclusively constructed in a dock or dry-dock.

Because of their length these building sections have heretofore been constructed horizontally; after being made water-tight they are in some way or other removed from the dock or dry-dock, and taken to the place of destination.

When, with this conventional method of horizontally constructing tunnel sections of relatively large dimensions, no dock or dry-dock is as a rule available, a special dock has to be built.

Apart from the great expenditure attending such a method, there is yet another drawback attached to it by that the construction of the sections is held up a considerable time pending the building of the dock.

The method of horizontally constructing sections, which has so far been almost the only method in use, moreover requires a costly mould for casting the concrete in the reinforcements.

The invention is meant to remove the said drawbacks attending the horizontal construction of tunnel sections, and to provide a method which will make the construction of tunnel sections considerably cheaper and quicker than the conventional method of horizontal construction.

The invention thereby does away with the dock required for a horizontal construction by building the tunnel section vertically below and above water-level.

French Patent No. 694,259 suggests the vertical construction of a well foundation or pile work structure from a floating member by means of a sliding mould. After the concrete section is finished, it is left on the spot.

The French patent merely describes the construction from a floating member 1, 2, 3 of a well foundation or pile-work structure 6 by means of a sliding mould. This system carries the great risk that the least improper movement of the floating member may upset the setting section, or that part of the section that is in process of setting, during the setting in the sliding mould. This is inadmissible, and must be kept under control. This control has been provided in the working method of the patent application by the use of the building box or shaft suggested therein.

The method of the French patent does not provide for a proper way of turning the finished section over from the vertical to the horizontal position.

This is not provided for in the conventional method either, since the finished sections are left in a vertical position on the spot.

German Patent No. 642,894 describes a method for the

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construction of concrete building sections of a limited height; with this method a double-walled box or shaft is used consisting of sectional parts, whereby the shaft serves as a non-sliding mould; the cast sections can thereby only be removed by dismantling the mould. This is a very costly method, the more so as the dismantling has to be carried out under water, and the mould has to be re-erected every time a section is finished.

According to the method of the present application the section can be removed from the mould after being put in a horizontal position (contrary to the German patent, which has no such provision); the building box or shaft can now at once be employed for the next section.

To eliminate the aforesaid drawbacks the present invention is characterized by fitting between the tunnel section and an opening in the floating member, a conventional double-walled box, shaft or similar member; the part of the section below water-level is built by filling the double-walled box or shaft with water, while the part of the section above water level is built by gradually draining the box or shaft, and by moving the sliding mould upwards inside the rising box; when the section is finished the mould is turned over with the box or shaft after removing a detachable part of the floating member; the section is then removed from the box and transported to the place of destination.

The apparatus applying this method, which is provided with a floating member and a sliding mould, is characterized by a conventional double-walled box or shaft fitted inside the building opening of the floating member, so that the buoyancy of the box or shaft can be regulated by the quantity of water admitted to the box; the sliding mould moves in a vertical direction inside the box, while the floating member is in addition provided with a detachable part with a minimum width of the outside diameter of the box or shaft.

By reference to the attached diagram a detailed description of a construction of the apparatus applying the method of the invention follows.

In the diagram:

FIGURE 1 is a longitudinal vertical section of the construction of the under water part of the tunnel-section;

FIGURE 2 is a longitudinal vertical section like FIGURE 1, showing the construction of the section above water level;

FIGURE 3 is a top plan view of the assembled apparatus.

In building a section of great length, e.g. a tubular section 1, the method of the invention employs an apparatus consisting of a floating member or platform 2, such as a raft, ship, etc., provided with a building opening 8 with a detachable float member 3, of the same width as the building opening. See FIGURE 3. In the building opening 8 a double-walled box, float, or shaft 5 may be round, oval, rectangular, square, or of any other cross sectional shape.

With the method of the invention this box or shaft 5 serves a dual purpose. In the first place it acts as a guide for the movable sliding mould 4, secondly it is used to turn the finished section over from the vertical to the horizontal position, and to transport the section to the place of destination.

In the initial stage of constructing the section, i.e. when building the section below water level, the double walled box or shaft 5 is filled with such a quantity of water as to make it rest on the bottom-plate 6; from the floating member 3 the part of the section 1 is then built inside the box or shaft 5 by means of the sliding mold 4, till this part rests on the supporting-plate 7 on the bottom-plate 6, as shown in FIGURE 1.

Then follows the construction of the part of the section 1 above water level (FIGURE 2), whereby the box or

shaft 5 is raised by gradually draining off the water, and the sliding mould is moved upwards.

FIGURE 2 shows the finished section 1 after the sliding mould is removed. The member 3 of the floating member or raft 2 is removed (FIGURE 3), thus clearing the lateral slit of the floating member. The section together with the box or shaft is then turned over from the vertical to the horizontal position, the box or shaft 5 serving as a support for the section. In this horizontal position the finished section is removed from the box or shaft, and transported to the place of destination.

Within the scope of the invention the floating member 2 may be fitted with vertical guides 9 to lead or support the float or box 5 by means of rollers.

When turning over the section the bearing power of the box 5 may be used to check the forces thereby produced.

It is evident, that the above specification and diagram only describe the substance of the invention, and that many modifications are possible within the scope of the invention.

I claim:

1. An apparatus for the construction in and over water, of elongated concrete tubes, comprising, first and second separable floating platform sections conjointly defining a central guide opening, a float comprising inner and outer radially-spaced coaxial walls interconnected at their lower ends by a water-tight partition, means carried by at least one said platform section to guide said float for vertical translation within said central guide opening, and a mould slidably fitting the inner walls of said float for guided vertical translation in and along the same.

2. An apparatus as in claim 1, said mould comprising inner and outer radially-spaced sleeves defining between them the cross-section of a tube to be constructed.

3. That method of constructing tubular concrete sections below and above water, comprising, flooding the interwall space of a vertical, tubular, double-walled float until one end rests on a submerged bottom plate, lowering a double-walled mould within the inner wall of said float,

to rest on the plate, filling with concrete the interspace between said mould walls, moving said mould upwardly relatively to the float while pouring concrete into the upper interwall portion of the mould thus evacuated, expelling water from the interwall space of said float to gradually raise said float relatively to said mould, continuing the upward movement of said mould in and relatively to said float while pouring concrete as aforesaid until the section is completed, tilting the float and completed tubular section as a unit into horizontal floating position, and axially translating said section out of said float.

4. That method of constructing tubular sections of concrete below and above water comprising flooding interwall space of a vertical double-walled float until its lower end rests on bottom, lowering a double-walled mould slidably fitting the inner wall of said float, until said mould rests on bottom, raising the mould relatively to and within the float, while pouring concrete into the upper end of the interspace between the walls of the mould thereby evacuated, removing water from said float to elevate the same relatively to said mould, and continuing raising of said mould within the float while pouring concrete thereinto, until the tubular section is completed, removing the mould from the float, tilting the float and section into horizontal floating position, and axially moving the floating section out of the float.

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